Spring 2012

Research Assignment

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Course Assignment

OVERVIEW: The purpose of this assignment is to expose you to the practice of conducting independent research into an unfamiliar area. You will choose a current area of active scientific research in electrical engineering related in some way to electromagnetic phenomena (more on the choices shortly). You will a) conduct a literature search to identify and understand the key papers in this subject area, b) introduce the topic in a presentation to the class, and c) prepare a report that describes the history of the development of the research topic.

GENERAL GUIDELINES:

- All reporting should be in 12-pt font with 1" margins at 1.5 spacing.
- All referencing should be in the IEEE style. For more information, see the following link: http://www.ijssst.info/info/IEEE-Citation-StyleGuide.pdf

1. TOPIC & JUSTIFICATION (January)

The first task is of course to choose an interesting topic! Here are the rules:

i. It must be a subject in electrical engineering and/or involving electromagnetic phenomena (interdisciplinary works are fine but there must be a strong EE component).

ii. It must be a relatively new area of research – that means, no "mature technologies". A quick way to tell if your subject is "mature" is to go to the library… if there are more than five books on it, it's too old. This requirement can be waived if you provide a compelling reason, or it is already on my list of suggested topics.

iii. There must be ongoing research in this area as evidenced by recent (0-5 years) publication activity in the area.

iv. The subject is unique to you; nobody else may choose the same topic.

A list of suggestions will be provided, but you are free to choose any topic that meets these criteria. All topic choices are subject to final approval by me; to this extent, I expect you to be able to justify that your topic has enough merit and material out there to work with successfully for the remaining parts of the assignment.

DELIVERABLE: You will submit a one-page justification in which you identify your topic, explain your present understanding of the topic. ***Do not*** include equations and images. ***Do*** mention what potential applications for this area of research are, and why you think this area is worth investigating. Language and structure of this submission can be informal.

2. LITERATURE SEARCH (February)

You will carry out a literature search on the topic you chose. Sources may include *journal publications, conference proceedings, articles* in a scientific journal, and *books.* You **must** identify in your search at least one work in the following three categories:

i. An ***originating paper***. This is a publication that is widely considered the key work in starting or moving forward the area of research. In some cases it will be obvious (i.e. all works in the field cite this one). In others, you will have to go digging and you may find more than one eligible paper with a claim to significance.

ii. A ***literature review*** article or book. This is a work which summarizes the state-of-the-

art in a particular subject. It will frequently cite other, recent works in the area in an attempt to collect a lot of results in one place. This will also give you a good picture of where the technology is right now.

iii. A ***technology roadmap*** article. This is a future-looking article that discusses or hints at possible applications or breakthroughs expected or hoped-for in this area. This is a speculative piece and is more likely to be found in a popular journal (e.g. IEEE Spectrum) or a conference proceeding. It does not itself rely on published results by the author, but is often written by experts in the field.

It is possible you will find ii and iii in the same work – this is permissible, but only if there is enough material for you to complete your timeline report (see the section below).

DELIVERABLE: You will prepare two items in a **Literature Search Report** during this phase:

1) An IEEE-style annotated bibliography of all the relevant articles/papers/works you uncovered that you believe are of interest. You should probably have at least 10 papers/sources identified. Be sure to number them – you will be referring to these in your other reporting.

2) A two page report in which you identify the three papers/sources above (i, ii & iii). For each of these choices, provide justification: i) Provide evidence that the originating paper(s) are indeed works of significance. ii) Discuss which papers in your spreadsheet are mentioned in your literature review source. iii) Discuss where you found the roadmap article and what kind of audience is reached by the journal/proceeding in which you found it.

3) A one-to-two page report documenting your process in finding these works. What methods did you use? Which papers lead you to others? What search terms yielded the best results? Be specific and refer to your bibliography.

3. PRESENTATION (March)

You will be asked to prepare a short (12-15 minute) presentation on your subject to the class. The intent of the presentation is to inform the class, an educated and intelligent (I hope) audience of engineers, of the subject area. A successful presentation will both address the basic theory of the subject matter while also keeping in mind where this technology may one day be applied. It should involve both the past (theoretical background), present (what problems are being worked out), and future (intended applications) of the technology. Powerpoint is fine and probably typical for this kind of thing, but you are free to be creative. Your presentation will be graded by myself AND your peers on content, clarity, and question fielding.

4. TECHNOLOGY TIMELINE REPORT (April)

You will prepare a ~10 page document exploring the subject area in a unique way. The paper will have a short introduction, followed by sections dedicated to the **past, present** and **future** of the technology. Central to each part will be the information you obtain from the sources you identified above. A more detailed description of the requirements for this report will be made available.

- The document will be prepared in two-column, IEEE format for journal submissions, however please use 12-pt font and retain 1.5 line spacing. The template for this can be found at: http://www.ieee.org/conferences_events/conferences/publishing/templates.html

- The paper will be written formally and without reference to yourself (even as “the author”) and make every effort to write as professionally and clearly as possible. Look to the papers you just read for some examples of how the tone should sound.
- The paper will contain an abstract (<200 words), IEEE keywords (search terms), and a short but descriptive introduction.
- The “past” section (call it “historical perspective”) will describe the originating discovery in detail: it must follow the development in technical detail. If there is a mathematical derivation, include the highlights of it in such a way that it can be followed by someone reading this work. If there is a key image from the original work, include it **with proper referencing**.
- The “present” or “state-of-the-art” section will describe what activities have been going on in the past 5 years, based on your findings. Identify the key research labs or universities involved.
- The “future” or “roadmap” section should connect the dots between current research and the ambitions for success in the roadmap article. What challenges need to be addressed to succeed? How far off do they seem (and why)?

TIMELINE REPORT GRADING: a detailed grading scheme for this report will be presented in March to help you sharpen your focus, but it roughly split 50/50 between content (technical material, understanding) and style (organization, writing, appearance, referencing).

Table - Assignment Grading Scheme

Deliverable	% of assignment grade		Due Date
Topic & Justification	10%		Jan 25th
Lit. Search Report	20%		Feb 24th
Presentation	30%		Week of March 26th
Technology Timeline Report	Content 20%	Style 20%	April 25th